

Comorbidities of Chronic Obstructive Pulmonary Disease and Their Affect on Hospitalization of Patients in a Tertiary Care Hospital

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ABSTRACT

Introduction: COPD is an obstructive airway disease with significant systemic comorbidities that affect hospitalization and the overall severity of the disease. The aim of the study was to assess the prevalence of comorbidities and their effect on the hospitalization of COPD patients.

Methods: The study was a cross-sectional study conducted in 2013 among patients of a tertiary care hospital. The sample size was 106. Inclusion criteria were diagnosed patients of COPD according to GOLD criteria. Patients were diagnosed with COPD based on GOLD criteria guidelines and evaluated for various comorbidities based on presenting complaints. Variables collected were the number and kind of diagnosed comorbidities, the average number of hospitalizations per year. The prevalence of each comorbidity was found out and the chi-square test ($p < 0.05$) was used to find out the correlation between hospitalization and comorbidities.

Results: Of 106 participants, 63.2% had at least 1 comorbidity. 37.73% had 2–4 comorbidities. Prevalence of diabetes mellitus was 35.8%, systemic hypertension was diagnosed in 47% of the subjects. 5.7% had left heart abnormalities, 4.7% had ischemic heart disease (IHD), and 16% had pulmonary arterial hypertension. 43.4% had gastroesophageal reflux disease and gastric ulceration, 38.6% had metabolic syndrome and 8.5% had obstructive sleep apnea, 8% had psychiatric disorders, 7.5% had osteoporosis, and 1.9% were diagnosed with lung malignancy. There was a significant association between mean hospitalizations and the presence of comorbidities ($p < 0.05$). Hospitalizations were majorly due to exacerbation of COPD.

Conclusion: Prevalence of comorbid conditions among COPD patients are concluded to be high with an adverse effect on the average number of hospitalizations per year.

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1. Introduction

Chronic Obstructive Pulmonary Diseases (COPD) is a complex disease that involves more than airway obstruction and has significant systemic effects that initiate or worsen co-morbid diseases. According to the World Health Organization (WHO), it is estimated that about 3 million deaths were caused by the disease in 2015 (that is, 5% of all deaths globally in that year). More than 90% of COPD deaths occur in low and middle-income countries like India [1]. The projection is that by the year 2020, COPD would become the third leading cause of death globally [2]. Some studies evaluating the cause of death in patients with COPD suggest that the patients are more likely to die of comorbid conditions than from COPD [3]. There is a lack of information on setting priorities for research and designing therapeutic strategies that address COPD within the context of comorbidity. Our study aims at addressing the lack by studying the prevalence and effects of comorbidities in COPD patients.

2. Materials and methods

This cross-sectional study was carried out in a tertiary care hospital in the city of Mangalore, in the Southern State of Karnataka, India for a period of 6 months. Approval was obtained from the Institutional Ethics Committee (IEC). A total of 106 COPD patients attending the outpatient department (OPD) or those admitted in the study hospital during the study period was included in the study, and they were selected by using a convenient sampling method. The Inclusion Criteria were patients above 40 years of age diagnosed with COPD according to GOLD guidelines, visiting outpatient ward and patients admitted into the inpatient wards with COPD [4]. Patients with concomitant diseases such as pneumonia, tuberculosis, bronchial asthma, interstitial lung disease, and other lung pathologies were excluded.

After taking a written informed consent from the subjects, the questionnaire with variables of age, gender, BMI was administered. Patients were also tested using standardized spirometry [5]. Relevant diagnostic tests were performed for patients presenting

symptoms other than COPD or any abnormalities detected during the examination to confirm a diagnosis of coexisting diseases. Blood sugar levels (fasting and post-prandial) were used to diagnose type 2 diabetes mellitus by a physician. Systemic hypertension was diagnosed by a physician based on blood pressure recordings. Cardiovascular abnormalities like pulmonary arterial hypertension (PH), Ischemic Heart Disease (IHD), left heart abnormalities were diagnosed by 2D Echo by a cardiologist. PH is defined as mean Pulmonary Arterial Pressure (PAP) ≥ 25 mmHg, according to the European Heart Journal, 2015 [5,6]. Depression, bipolar disorder, and other were diagnosed by a psychiatrist through standard clinical procedures. GERD was diagnosed by symptomology and/or by Upper GI endoscopy by physicians. Anemia was diagnosed by peripheral smear and hemoglobin percentage by a pathologist. Osteoporosis was diagnosed using the Bone Mineral Density test and as per the opinion of orthopedician. Obstructive Sleep Apnea was diagnosed by polysomnography. Lung Cancer was diagnosed by a CT scan and bronchoscopic biopsy. Previously diagnosed comorbidities were also noted from the patient's case sheet. The average number of hospitalizations due to COPD exacerbations per year of each patient was noted from the patient's hospital record. All the subjects of our study were treated according to the latest GOLD guidelines [4]. The prevalence of various comorbidities was calculated. A Chi-square test was done to find the association between the average number of hospitalizations per year and various comorbidities. A p-value of <0.05 was considered to be statistically significant.

3. Results

Out of the 106 participants in the study, 63.2% were diagnosed with at least one comorbidity. More than 60% of our patients presented with multiple comorbidities with 47% of our subjects were diagnosed to have more than 2 comorbidities. Prevalence of type 2 diabetes mellitus and systemic hypertension was high in our study sample with 35.8% and 47% prevalence, respectively. About 25% of the study sample was diagnosed with cardiac abnormalities such as pulmonary arterial hypertension, left-sided cardiac abnormalities, and ischemic heart disease. The prevalence of various comorbidities is summarized in Table 1.

The data of the average number of hospitalizations in a year of our study sample are summarized in Table 2. More than 80% of our study population was hospitalized once a year with about 50% of the subjects being hospitalized more than once per year. Hospitalizations were majorly due to exacerbation of COPD while the patients presented with symptoms of comorbidities

were tested and treated as per guidelines during their stay in the hospital.

Subjects with comorbidities were hospitalized, mainly due to COPD exacerbations more number of times in a year as compared to that of the COPD subjects without comorbidities ($p < 0.001$).

4. Discussion

Studies prove beyond doubt that COPD can no longer be considered as an isolated lung disease. Inflammation appears to play a central role in the pathogenesis of COPD and other conditions that are increasingly being recognized as systemic inflammatory diseases [7,8]. 95.28% of our subjects were males and 4.72% were females. In India, besides smoking, domestic smoke from firewood burning is also a cause for COPD among females [9].

About 63.2% of the study population were diagnosed to have at least one comorbidity. The prevalence of comorbidities varied from study to study. In a study by Fumagalli et al. reported that 94.1% of the patients had comorbidities [10]. Sin DD et al. reported a prevalence of 66.67% comorbidities in their patient sample [11]. Subjects with comorbidities in our study were found to have higher and statistically significant hospitalizations in a year ($p < 0.001$). The study by Fumagalli G et al. reported that patients with comorbidities had frequent readmissions and a longer stay at the hospital [10]. Holguin F et al. in their retrospective study involving COPD patients from 1979 to 2001 in the USA has noted that a large proportion of patients admitted to the hospitals for comorbid conditions [12]. A study by Terzano C et al. on hospitalization and mortality on COPD concluded that cardiovascular

Table 1. Prevalence of various comorbidities in the study sample (N = 106).

Comorbidity	Prevalence (in percentage)
Type 2 Diabetes Mellitus	35.8%
Systemic Hypertension	47%
Left sided Cardiac Abnormalities	5.7%
Pulmonary arterial hypertension	16%
Ischemic heart disease	4.7%
Metabolic Syndrome	38.6%
GERD and Gastric Ulceration	43.4%
Anemia	4.7%
Obstructive sleep Apnea	8.5%
Osteoporosis	1.9%
Lung cancer	1.9%
Psychiatric disorders	8%

Table 2. The average number of hospitalizations per year among the study population (N = 106).

Average Number of hospitalizations per year	Percentage of the study sample
0	17.9%
1	30.2%
2	34.6%
3	15.1%
>3	1.9%

causes in COPD patients are the second most common cause for hospitalization of COPD patients after acute exacerbation of COPD. Stroke Peptic ulcer bleed, lung malignancy, pulmonary embolism, etc., were other significant causes of hospitalization [13]. It was also found out that comorbidities like hypertension, cardiac abnormalities, and diabetes mellitus were found to be independently associated with increased frequency of hospitalization ($p < 0.001$). Mannino D M et al. in their study made a similar observation [14].

The prevalence of diabetes mellitus was found out to be 35.8% in the study sample. D M Mannino et al. reported the prevalence of Diabetes Mellitus to be 12.7% in the study sample [14]. Holguin F reported the prevalence of diabetes to be 11% [12]. Cazzola M reported a prevalence of 18.2% [15]. High prevalence of Type-2 Diabetes Mellitus is attributed to the insulin resistance, as a result of both COPD and smoking, which is also a major risk factor for COPD [7]. 44.3% of subjects were diagnosed to have systemic hypertension in our study sample. A study by D M Mannino et al. reported a similar prevalence of hypertension at 40.1% in their study sample [14]. Holguin F et al. reported the prevalence of hypertension to be 50.1% [12]. Cazzola M et al. reported a prevalence of 18.2% [15].

Cardiac abnormalities were diagnosed in 22.3% of our study subjects. Mannino DM et al. reported the prevalence of cardiovascular abnormalities to be 15.20% in their study sample [14]. In a retrospective study by Cazzola M et al., cardiac abnormalities that include ischemic heart disease, heart failure, arrhythmia, pulmonary circulatory abnormalities were found to be prevalent in 26.6% of the patients [15]. Hypoxemia which may result in the release of inflammatory cytokines like IL-6 that plays a role in increasing CRP and TNF – alpha which increases Inflammation and plays a very important role in atherosclerosis. Hypoxia during exacerbations or exercise in COPD patients is said to be a risk factor for cardiovascular events [7]. IHD was prevalent in 4.7% of our study sample. Cazzola M et al. concluded that the prevalence of IHD was 13.6% in COPD patients as compared to 6.9% in the general population [15]. Stroke is prevalent in 0.9% of the study sample is said to be a significant cause of hospitalization of COPD patients [16].

Pulmonary Hypertension was diagnosed in 16% and is the most common cardiac abnormality in our study sample and left heart abnormalities were prevalent in 5.7% of our study sample. A study by Frexia X et al. reported a similar prevalence of pulmonary hypertension and concluded that right heart abnormalities are more prevalent than left heart abnormalities in COPD [17]. In a study by Cavaillès A et al. pulmonary hypertension was prevalent in about 5%–40% of COPD patients [18]. Remodeling of pulmonary vasculature resulting from hypoxia, loss of

capillaries in emphysema is said to be the main cause of PH in COPD patients [19].

Overlap Syndrome, the existence of both COPD and OSA was found in around 8.5% of the patients. Studies prove that obstructive sleep apnoea is a result of hypoxia in COPD patients [8]. In a study by Patel ARC, OSA was prevalent in 1–4% of the COPD patients [20].

The high prevalence of GERD and gastrointestinal ulcers in our study and study by Patel ARC could be attributed to the low-lying diaphragm due to hyperinflation, increased use of abdominal muscles for respiration, and medications like antihistamines and antibiotics that were prescribed to the patients during exacerbations [20]. Anemia was found in 4.7% of the patients. A study by Sarkar M et al. on COPD and prevalence of anemia found out that anemia prevalence could be 7.5–33% among COPD patients and most commonly due to anemia of chronic disease [21]. Osteoporosis was diagnosed among 1.9% of the study sample. Osteoporosis in COPD is as a result of the spillover of inflammatory indicators [7]. The prevalence of lung cancer was probably lower in our study as previously diagnosed lung cancers were excluded but only those with COPD in whom cancers were incidentally diagnosed were included.

5. Conclusions


This study concluded that the prevalence of comorbidities is high among subjects of COPD and patients with COPD were hospitalized more than the subjects without comorbidities. Probably a study with a larger number of subjects would be required to make a more conclusive analysis on sub-set of COPD comorbidities as independent risk factors for hospitalization and exacerbation. A long term follows up over a period of 5 years would have predicted the outcome of the disease and disease burden better.

Disclosure statement

Dr. Venkata Sai Hari Kalyan Sridhara declares no conflict of interest

Dr. Vishak Acharya K does declares no conflict of interest.

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